DOCUMENT RESUME

ED 451 811 HE 033 941

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TITLE	An Analysis of Learning Styles among Full-Time Undergraduate College Students.
PUB DATE	2001-00-00
NOTE	22p.
PUB TYPE	Reports - Research (143)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	*Cognitive Style; Enrollment; Ethnicity; Higher Education; Intellectual Disciplines; *Sex Differences; *Undergraduate Students

ABSTRACT

In the fall semester, 1999, a random sample of 814 undergraduate college students attending a southern land grant university were asked to complete a Learning Style Profile (LSP). Students were aged 17 to 58 years, with the mean age being 23. The LSP measured students' perceptual response study and instructional preferences. Inferential statistics were used to determine if there were differences in learning style across year of enrollment, college of enrollment, ethnicity, and gender. For gender, there were significant differences in seven areas. Results also show three areas where significant differences existed among ethnic groups: posture, temperature (environmental), and verbal risk. Seven subscales demonstrated statistically significant differences among disciplines. Differences in learning styles were also evident across year of enrollment, with freshmen preferring to learn and study later in the day, and junior and senior students preferring quiet environments. Results demonstrate differences among learning styles across disciplines, gender, ethnicity, and year of enrollment and provide information for research and teaching. (Contains 5 tables and 20 references.) (SLD)

Running Head: An Analysis of Learning Styles Among Undergraduate College Students

An Analysis of Learning Styles Among Full-Time Undergraduate College Students

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Abstract

In the Fall Semester, 1999, a random sample of undergraduate college students attending a southern land grant university were asked to complete a Learning Style Profile (LSP). The LSP measured students' perceptual response study and instructional preferences. Inferential statistics were used to determine if there are differences in learning style across year of enrollment, college of enrollment, ethnicity and gender. Results demonstrate differences among learning styles and provide information for research and teaching.

Introduction

Perhaps at no other time has there been more discussion, thinking, and tension about issues of diversity in higher education than there is now. Nevertheless, educators continue to use the same traditional environments, instructional practices and methods, showing little concern for the academic potential of students except those with gross deficits (Forsika, 1992). The result is ill-prepared students and a high drop-out rate (Green & Parker, 1989).

In response, institutions are seeking strategies for attracting, retaining, and ensuring the success of students (Brown, 1986, Carney & Hopperstead, 1986, Pascarella, 1986). Given these institutional goals learning style assessment programs may hold great promise (Green & Parker, 1989).

Learning style is a hypothetical construct that is intended to help explain the learning process. However, scholars differ in their definition and interpretation. Hiemstra and Sisco (1990) define learning style as the cognitive, affective, and physiological traits that indicate how learners perceive, interact with, and relate to the learning environment. Sewall (1986) refers to a learning style as an individual's unique way of interacting with the environment. Kolb (1984) views learning styles as possibility-processing structures that are an outgrowth of experiential learning. Gregorc (1979) defines learning style as a construct consisting of distinct behaviors that serve as indicators of how a person learns from and adapts to his or her environment. Della-Dora and Blanchard (1979) refer to learning style as a personally preferred way of dealing with information and experience for learning that crosses content areas.

Perhaps the most descriptive statement of learning style can be found in Smith's (1982) definition, when he states:

> What do we mean by style? It has long been apparent to teachers, educators, and observers that people differ in how they go about certain activities associated with learning. They differ as to how they approach problem solving. They differ as to how they go about information processing, or putting information through their minds. Some people like to get the big picture of a subject first then build to a full understanding of that picture. Other people like to begin with examples and work through to a meaningful construct. (p. 23)

Marshall (1987) argues that how information is presented to students may be more important to the learning process than the general aptitude of students

The usefulness of the learning style concept and various diagnostic approaches has been demonstrated in terms of student achievement, the inhibiting of dropout rates, and increasing students' satisfaction with instruction (Cross, 1983). Smith (1983) argues that knowledge of one's preferences and tendencies in learning and information processing can be helpful in making choices about what, when, where, and how to learn; it can also help pinpoint personal difficulties or explain problems with particular subjects, methods, or instructors. Learning style diagnosis can also help educators to understand some of their assumptions about teaching and learning and their behavior instructional situations, since people tend to teach as they prefer to be taught (Smith 1983).

Murrell & Claxton (1987) offered advice as to how learning style assessment

could be used in education and teaching. Their suggestions included the use of active experimentation so students may discover their learning styles. They also advocate the use of learning style assessment to help students choose an area of study.

With faculty under considerable pressures, oftentimes they may not have the means, or the time necessary to assess every student's learning style. What may be helpful is a database of information about students' learning styles in various academic centers and situations. With this information in hand, faculty may be better able to develop teaching modalities better suited to individualized instruction. Therefore, the goal of this project is to provide educators, researchers and scholars with information about students' various learning styles.

Method

In the Fall Semester, 1999, a random sample of undergraduate college students attending a southern land grant university were asked to complete a Learning Style Profile (LSP). Students were identified as potential participants if they were pursuing a BS/BA degree, were enrolled for a minimum of 6 semester hours, and did not possess a bachelor's degree. Working with the registrars' office, attempts were made to select students representative of the universities' undergraduate population. The LSP was administered to students in group settings. The process was entirely voluntary and no course credit or other remuneration was given for participation.

The protocol for the Profile's administration was as follows. Subjects were told that this was a research project, all information was confidential, and participation was entirely voluntary. Students were given a demographic answer sheet and asked to

provide basic descriptive information. Descriptive information collected included age, sex, ethnicity, class rank (freshman, sophomore, etc.), college where student is seeking a degree (engineering, arts and sciences, etc.), if they were enrolled in six or more credit hours for fall semester, and if they possessed a diagnosed learning disability. After the demographic information was collected the Learning Style Profile was handed out and directions for administering the Profile given in the Learning Style Profile Examiner's Manual were followed.

The Learning Style Profile's revised edition (1989) served as the data collection instrument. The Profile consists of 126 questions representing 4 independent constructs: cognitive skills, perceptual response, study preferences, and instructional preferences. The Profile requires approximately 60 minutes to finish. The scale definitions and number of items are presented in Table 1.

Past research has established evidence of reliability for the subscales perceptual response, study preferences, and instructional preference (Hardigan, 1996). However, Hardigan (1996) was unable to demonstrate evidence of validity or reliability for the cognitive subscales. Therefore, only data from the subscales perceptual response study preferences, and instructional preferences were used in the analysis.

Descriptive statistics were calculated for each subscale via enrollment year, college of enrollment, ethnicity and gender. Analysis of variance (ANOVA) was used to determine if differences exist by subscale across year of enrollment, college of enrollment, and ethnicity. Independent t-tests were conducted to see if differences exist based on gender. A-priori significant levels were set at 0.05.

Results

Nine hundred and thirty-seven undergraduate college students completed a Learning Style Profile (LSP). One hundred and twenty-three were removed from the data analysis because of missing or incomplete data. Therefore, eight hundred and fourteen students formed the sample for all statistical analysis. The mean age of subjects was 23, with the oldest being 58 and the youngest 17. All subjects were enrolled in traditional BS/BA programs.

Independent sample t-tests were calculated for each subscale with gender serving as the independent variable. Results indicate seven areas where significant differences exist (Table 2). A few areas are worth noting. First, female subjects prefer quiet, warm areas to study and learn while males enjoy a cooler environment with more interactions. Second, males possess a greater willingness to state opinions even in the face of disagreement.

Analysis of variance was employed to see if there are differences in subscales scores based on ethnicity. Results show three areas where significant differences exist—posture, temperature, and verbal risk (Table 3). Of particular interest, Asian subjects prefer a formal posture while learning and are less willing to engage in verbal interaction when perceptions of risk are high. Hispanic subjects prefer cooler environments in which to study and learn.

Analysis of variance was used to see if differences in learning styles exist across disciplines. Seven subscales demonstrated statistical significance (Table 4). Of note,

engineering students favored psychomotor learning assignments while undecided majors reported less persistence in completing assigned tasks.

The final statistical test was used to see if differences in learning styles are evident across year of enrollment. ANOVA was employed and results show five areas of difference (Table 5). As a group, freshmen prefer to learn and study later in the day, while junior and senior students prefer to study and learn in quiet environments.

Discussion

It should be noted that this analysis examined group differences. In doing so one may be left with the impression that all students in the groups behave the same. Of course, this is not true and individual differences must be accounted for when applying the results. Nevertheless, the results are noteworthy for a number of reasons.

The results provide empirical data that demonstrates that differences exist across disciplines, gender, ethnicity and year of enrollment. This adds to the growing body of research in vocational psychology which demonstrates that students with specific learning styles tend to choose particular professions (Mathews, 1992; Stewart & Felicetti, 1992). For example, Mathews (1992) found that mathematics and humanities students were more independent and applied while education majors preferred social and conceptual situations (Mathews, 1992). Even within a discipline differences in personality traits are evident. Stewart discovered a significant difference in personality between undergraduate marketing students pursuing degrees in sales or advertising and undergraduate marketing students pursuing degrees in marketing management (Stewart & Felicetti, 1992).

More importantly, however, is the impact this knowledge may have on learning outcome. Studies have demonstrated a relationship between academic performance and students who were taught in their preferred learning style (Wratcher, 1991). For example, Nelson & Stake (1994) found that college students who were assessed on their learning styles, received an interpretation of their strengths and weaknesses, and were provided instructional sessions on applying these strengths and weaknesses achieved significantly higher grade-point averages and higher retention rates than those students: (a) who were assessed on their learning styles and only received an interpretation of their strengths and weaknesses, and (b) those who received no learning style intervention.

It appears evident that learning style assessment has a positive affect on learning. As such, instructors who are aware of the differences in learning style may be better able in developing superior instructional techniques. Furthermore, If class size prohibits individualized instruction, efforts can be made to accommodate the differences by varying presentation and assessment techniques. Data from this study facilitates this process by informing instructors of the differences that they may encounter when entering the classroom. The ultimate goal of which is to provide a learning environment that allows students to take advantage of their learning strengths while assisting them in accommodating differences.

Limitations

The study discovered significant and practical differences; nevertheless, limitations in the study should be noted. First, subjects were enrolled in a large

southern university. As such, unique demographics that influenced the study may not be evident in other locals. Second, the study examined aggregate data, individuals may differ from the demographic groupings.

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Table 1

Learning Style Profile Subscales and Definitions

Subscale	Number of Items	Definition
Analytic Skill	5	The analytic skill subscale (AS) is modeled after the Embedded Figures Test (EFT). Scores range from 0 (weak) to 5 (strong).
Spatial Skill	5	The spatial skills subscale includes two components of general spatial reasoning: (1) pattern recognition and (2) spatial rotation. Scores range from 0 (weak) to 5 (strong).
Discrimination Skill	5	The subscale measures a student's ability to focus on the important elements of the task. Scores range from 0 (weak) to 5 (strong).
Categorization Skill	8	The categorization skill subscale is based on the notion of 'equivalence range. Equivalence range can be subdivided into groups: (1) narrow and (2) broad categorizers. Scores range from 0 (weak) to 24 (strong).
Simultaneous Processing	5	Simultaneous processing is the synthesis of separate elements into groups. Scores range from 0 (weak) to 5 (strong).
Sequential Processing	6	Sequential processing is defined as the processing of information in serial order. Scores range from 0 (weak) to 6 (strong).
Memory Skill	12	The subscale is a variation on a series of tests designed to assess the cognitive control of leveling versus sharpening. Scores range from 0 (weak) to 12 (strong).
Verbal-Spatial Preference	6	The verbal-spatial preference subscale elicits the subject's preference for verbal or spatial meaning. Scores range from 0 (high spatial) to 5 (high verbal).
Manipulative Preference	4	Preference for hand-on activities. Scores range from 4 (low) to 20 (high).

(table continues)

Perceptual	20	The perceptual response subscales are patterned after the
Response	20	Edmonds Learning Style Indicator (ELSIE).
Visual	20	Scores range from 0 (weak) to 20 (strong).
Auditory		Scores range from 0 (weak) to 20 (strong).
Emotive		Scores range from 0 (weak) to 20 (strong).
Verbal Risk Orientation	4	The verbal risk orientation subscale measures a student's willingness to verbalize, state opinions, and to state opinions even if others disagree. Scores range from 4 (low) to 20 (high).
Grouping Preference	5	The grouping preference subscale is composed items that identify a learner's preference for whole class, small group or dyadic instruction. Scores range from 5 (small) to 25 (large).
Persistence Orientation	4	The persistence orientation subscale uses items to assess a student's willingness to work at difficult tasks until completion. Scores range from 4 (low) to 20 (high).
Study Time Preference		Study time preferences are individual variations in learning readiness and attention related to the different times of the day.
Early morning	2	Scores range from 2 (low) to 10 (high).
Late morning	2	Scores range from 2 (low) to 10 (high).
Afternoon	3	Scores range from 3 (low) to 15 (high).
Evening	3	Scores range from 3 (low) to 15 (high).
Posture Preference	4	The posture preference subscale assesses the learner's choice of formal vs. informal study arrangements. Scores range from 4 (informal) to 5 (formal).
Mobility Preference	4	The mobility preference subscales assess a learner's tendency to move about and take breaks while studying, or to work in place until finished. Scores range from 4 (stillness) to 20 (movement).

(table continues)

Sound Preference	4	The sound preference subscale measures a student's reaction to auditory stimuli Scores range from 4 (quiet) to 20 (sound).
Lighting Preference	5	The lighting preference subscale assesses a learner's preference for high or low levels of illumination for studying or thinking Scores range from 5 (dim) to 25 (bright).
Temperature Preference	4	The temperature preference subscale assesses a learner's preference of cool or warm study environments Scores range from 4 (cool) to 20 (warm).

Table 2.

Descriptive statistics and significant levels for subscales based on gender

Subscale	Group	N	Mean	SD	Sig.	ES
Evening	Male	322	9.99	2.52	P < .05	.16
	Female	492	9.59	2.60		
Light	Male	322	16.17	3.78	P < .05	.16
	Female	492	16.82	4.36		
Manipulative	Male	322	13.73	3.04	P < .01	.50
	Female	492	12.17	3.16		
Sound	Male	322	10.29	3.28	P < .01	.24
	Female	492	9.46	3.47		
Temperature	Male	322	9.91	3.09	P < .01	.26
	Female	492	10.78	3.51		
Verbal risk	Male	322	13.02	2.81	P < .01	.22
	Female	492	12.39	2.88		
Verbal-spatial	Male	322	3.12	1.33	P < .01	.18
	Female	492	3.36	1.39		

Table 3.

Descriptive statistics and significant levels for subscales based on ethnicity

Subscale	Group	N	Mean	SD	Sig.
Posture	Asian	75	15.38	3.20	*
	Black	71	13.94	2.68	
	Hispanic	140	14.31	2.88	
	White	483	13.82	2.80	
	Other	45	14.08	2.33	
Temperature	Asian	75	10.70	3.15	
	Black	71	11.35	3.13	
	Hispanic	140	9.82	3.45	*
	White	483	10.54	3.35	
	Other	45	10.22	3.57	
Manipulative	Asian	75	13.50	2.68	*
	Black	71	11.85	3.58	**
	Hispanic	140	12.70	3.57	
	White	483	12.86	3.09	
	Other	45	12.48	2.99	
Verbal risk	Asian	75	11.16	2.72	**
	Black	71	13.02	2.84	
	Hispanic	140	12.52	2.85	
	White	483	12.84	2.84	
	Other	45	12.73	2.74	

* The mean difference is statistically significantly higher ($P < .01$)
** The mean difference is statistically significantly lower ($P < .01$)

Table 4.

Descriptive statistics and significant levels for subscales based on college of enrollment.

Subscale	Group	N	Mean	SD	Sig.
Persistence	Business	107	14.36	2.63	
	Education	144	14.69	2.34	
	Health Sciences	78	14.10	2.77	
	Arts & Science	381	14.81	2.39	
	Engineering	27	14.03	2.44	
	Other	77	13.76	2.63	**
Light	Business	107	16.00	4.22	
	Education	144	16.94	4.36	
	Health Sciences	78	15.94	4.21	
	Arts & Science	381	17.00	4.05	*
	Engineering	27	14.92	3.89	
	Other	77	15.64	3.80	
Manipulative	Business	107	12.80	3.33	
	Education	144	12.63	2.97	
	Health Sciences	78	12.21	3.33	
	Arts & Science	381	12.74	3.11	
	Engineering	27	15.40	3.04	*
	Other	77	12.90	3.43	
Sound	Business	107	10.25	3.43	
	Education	144	9.94	3.56	
	Health Sciences	78	9.61	3.14	
	Arts & Science	381	9.37	3.33	**
	Engineering	27	11.74	2.91	
	Other	77	10.41	3.61	

* The mean difference is statistically significantly higher ($P < .01$)
** The mean difference is statistically significantly lower ($P < .01$)

table continues

Table 4.

Descriptive statistics and significant levels for subscales based on college of enrollment.

Subscale	Group	N	Mean	SD	Sig.
Temperature	Business	107	11.00	3.23	
	Education	144	11.06	3.25	
	Health Sciences	78	10.53	3.11	
	Arts & Science	381	9.74	3.39	**
	Engineering	27	11.11	3.25	
	Other	77	11.51	3.37	
Late Morning	Business	107	5.75	1.85	
	Education	144	6.40	1.83	*
	Health Sciences	78	6.33	1.76	
	Arts & Science	381	5.92	1.76	
	Engineering	27	6.18	2.13	
	Other	77	5.87	1.92	
Afternoon	Business	107	10.36	1.97	
	Education	144	10.59	1.76	
	Health Sciences	78	10.17	1.68	
	Arts & Science	381	10.58	1.74	
	Engineering	27	10.07	2.20	
	Other	77	9.96	2.00	**

* The mean difference is statistically significantly higher ($P < .01$)
** The mean difference is statistically significantly lower ($P < .01$)

Table 5.

Descriptive statistics and significant levels for subscales based on year of enrollment.

Subscale	Group	N	Mean	SD	Sig.
Early Morning	Freshmen	172	6.11	1.82	**
	Sophomore	138	6.19	1.75	
	Junior	210	6.43	1.70	
	Senior	294	6.58	1.75	
Group	Freshmen	172	15.55	2.20	
	Sophomore	138	14.91	2.00	**
	Junior	210	15.67	2.22	
	Senior	294	15.53	2.07	
Sound	Freshmen	172	10.68	3.71	*
	Sophomore	138	10.57	3.12	*
	Junior	210	9.31	3.25	
	Senior	294	9.24	3.32	
Mobility	Freshmen	172	13.33	2.93	
	Sophomore	138	13.01	2.84	
	Junior	210	12.53	2.75	**
	Senior	294	13.00	2.79	
Light	Freshmen	172	15.91	4.09	
	Sophomore	138	15.68	3.99	
	Junior	210	16.50	4.40	
	Senior	294	17.39	3.92	*

* The mean difference is statistically significantly higher ($P < .01$)
** The mean difference is statistically significantly lower ($P < .01$)

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